Name _____

Solving Complex Genetics Problems with the Rules of Probability

1. Flower position, stem length, and seed shape are three characters that Mendel studied. Each is controlled by an independently assorting gene and has dominant and recessive expression as follows:

- Axial flower position (A) is dominant over terminal flower position (a)
- Tall stems (T) are dominant over short stems (t)
- Round seeds (R) are dominant over wrinkled seeds (r)

If a plant that is heterozygous for all three characters is allowed to self-fertilize, what proportion of the offspring would you expect to be as follows: (AaTtRr)

A) Homozygous for the three dominant traits (AATTRR)

¼ x ¼ x ¼ = 1/64

B) Homozygous for the three recessive traits (aattrr)

¼ x ¼ x ¼ = 1/64

C) Heterozygous for all three characters (AaTtRr)

½ x ½ x ½ = 1/8

D) Homozygous for axial and tall, while heterozygous for seed shape (AATTRr)

¼ x ¼ x ½ = 1/32

2. The genotype of F_1 individuals in a tetrahybrid cross is AaBbCcDd. Assuming independent assortment of these four genes, what are the probabilities that F_2 offspring will have the following genotypes?

A) aabbccdd ¼ x ¼ x ¼ x ¼ = 1/256

B) AaBbCcDd ½ x ½ x ½ x ½ = 1/16

C) AABBCCDD ¼ x ¼ x ¼ x ¼ = 1/256

D) AaBBccDd ½ x ¼ x ¼ x ½ = 1/64

E) AaBBCCdd ½ x ¼ x ¼ x ¼ = 1/128

3. What is the probability that each of the following pairs of parents will produce the indicated offspring? (Assume independent assortment of all gene pairs.)

A) AABBCC x aabbcc → AaBbCc

1 x 1 x 1 = 1

B) AABbCc x AaBbCc → AAbbCC

½ x ¼ x ¼ = 1/32

C) AaBbCc x AaBbCc → AaBbCc

½ x ½ x ½ = 1/8

D) aaBbCC x AABbcc → AaBbCc

1 x ½ x 1 = ½